FERNANDO NORONHA.

Darwin landed on this island on the outward voyage of the *Beagle*, and collected a few plants, and Moseley succeeded in obtaining specimens of a few plants from the main island and the islet of St. Michael's Mount, but was prevented from making a complete collection in consequence of the *Challenger* being unprovided with the necessary authorization. These plants were described by the writer, and some of them figured in the "Botany of the *Challenger* Expedition." Provided with funds by the Royal Society, Mr. H. N. Ridley, formerly of the British Museum, and now Government Botanist for the Straits Settlements, visited the island in the summer of 1887, accompanied by Mr. G. A. Ramage and the Rev. T. S. Lea. The party remained on the island, or rather group, for there are several islets besides the main island, forming a chain, which may have formerly been continuous. Thus they had time to explore thoroughly the natural history; and an account of the botany, by Ridley, has just appeared in the current volume of the Journal of the Linnean Society. The singularly unconnected form of the introductory matter is doubtless due to the hurried manner in which it had to be completed before the author's departure for Singapore.

Fernando Noronha is in about 3° 50′ S. lat., and nearly 200 miles from the nearest point of the Brazilian coast. The whole chain is about eight miles in length, and the main island five miles long and nearly two miles across in one part, though very much narrower generally.

The fragment of the flora published in the "Botany of the *Challenger*" was considered sufficient to enable us to form an opinion of its general character, and state that there was no peculiarly insular element in the vegetation. This is fully borne out by the subsequent discoveries.

Mr. Ridley gives no analysis of the composition of the flora beyond classifying the plants as weeds, such plants as might be introduced by sea-currents, and such as have berries and eatable seeds, with examples; but he does not tabulate the whole. His very brief "summary" follows:—

"The whole group of islands possesses certain characteristics common to all truly oceanic islands and some of those which are merely the relics of vanished continents. In the first place there is the absence of indigenous mammals, and more noticeably of bats, of fresh-water fish, and amphibians. Again, the number of indigenous species, both of plants and animals, is very small, while the number of individuals is very large. The insects are small and dull in colour, and but few of the plants have showy flowers, white and yellow being prevailing colours. A considerable proportion of the indigenous plants are shrubby or arboreous, as in many other oceanic islands; but arboreous or even shrubby Compositæ do not exist, indigenous species of the order being rare in the group."

There will be differences of opinion, of course, as to the teachings of the data collected by Mr. Ridley and his companions, especially as to whether the present vegetation be a remnant of a former continental flora or a purely derived insular flora of comparatively recent origin.

Mr. Ridley himself states "that there is no evidence whatever to show a former connection with the mainland of Brazil at any time, in spite of what has been asserted by Dr. Rattray to the contrary." On the other hand, in a sketch of the geology of the island, based on petrological notes by Thomas Davies, which follows the enumeration, it is merely doubted "that the evidence is sufficient to prove a connection."

It appears, too, that "some American petrologists, who have found similar rocks to those of Fernando Noronha in the neighbourhood of Cape San Roque, seem to consider that the group may have been connected at one time with the mainland at this point."

Roughly counting the plants in the enumeration, we find there are nearly two hundred species of phanerogams, including weeds and a few others undoubtedly introduced, intentionally or unintentionally, by man. Out of this total, about thirty-two are described as new, or, in about half-a-dozen instances, more fully described than was possible from the imperfect material previously known. So far as present evidence goes, these are all endemic in Fernando Noronha; but while so much remains to be done in the investigation of the Brazilian flora, it should not be assumed that they are really so. Some of them, indeed, are admittedly very closely allied to previously-described species, and botanists might differ as to the propriety or expediency of treating the majority of them as independent species. And as to the whole, they present no peculiar characteristic suggesting the improbability of their occurring on the mainland.

The poverty of the flora in species may be largely due to climatal and other conditions. The climate is so dry generally, or the periods of drought are so protracted, that marsh plants, epiphytes, and ferns are almost wholly wanting. Mr. Ridley discovered one fern, *Pellæa geraniæfolia*, but it was rare and local, and this very widely-spread fern will grow in comparatively dry situations.

A large number of the plants, including several of the supposed endemic species, bear edible fruits; yet "there is only one fruit-eating bird on the island, and that is the endemic dove, *Zenaida noronhæ*." This fact tempts Mr. Ridley "to wonder whether the number of endemic species with edible fruit could possibly have all been introduced by this single species of dove, or whether other frugivorous birds may not at times have wandered to the shores." This sentence can hardly convey what Mr. Ridley had in his mind when he wrote; and being so distant from home he probably had no opportunity of revising it in print. Moreover, it is hardly correct to designate this group of islands as "oceanic."

Prominent in the vegetation among the assumed new or endemic plants are: *Erythrina aurantiaca*, *Cereus insularis*, *Bignonia roseo-alba*, *Pisonia Darwinii*, *Sapium sceleratum*, and *Ficus noronhæ*. There are also described two species of *Oxalis*, three of *Ceratosanthes*, a genus of Cucurbitaceæ, a *Sesuvium*, a *Cuscuta*, a *Physalis*, a *Solanum*, a *Lantana*, and three of *Cyperus*, besides a few others of less familiar genera. Of greater botanical interest is an apparently diœcious Combretacea, provisionally placed in *Combretum* as the type of a new section, *Terminaliopsis*. Taken as a whole, the vegetation is quite that of the mainland deprived of the moisture-loving element.

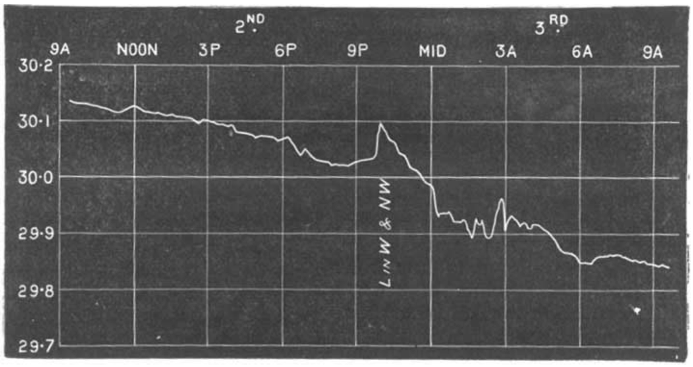
In conclusion, it may be stated that the woods mentioned by the earlier writers have almost disappeared since the main island has been made a convict settlement.

W. BOTTING HEMSLEY.

THE BRONTOMETER.

FOR more than a century meteorologists have been puzzled by the exceptional action of the barometer during some (not all) thunderstorms, and during some (but not all) heavy rains. As a general rule, one expects the barometer to fall for rain and bad weather, but in 1784 Rosenthal pointed out that "when a thunderstorm approaches the place where a barometer is situated, the mercury in the tube begins to rise; the nearer the thundercloud comes to the zenith of the observer, the higher does the mercury rise, and reaches its highest point when the storm is at the least distance from the observer. As soon, however, as the cloud has passed the zenith, or has become more distant from the observer, the weight of the atmosphere begins to decrease and the mercury to fall."

The recent rapid increase in the number of self-recording barometers in use has led to much interest being taken in these fluctuations, which are sometimes very numerous, and far from the simple rise and fall noted by Rosenthal, Planer, Toaldo, and other early writers. A very good illustration was afforded by my Redier barograph on August 2-3, 1879, of which the curve is reproduced below.



Camden Square, London, August 1879.

It might for a moment be supposed that the zig-zag about 2 a.m. was due to what is known as "pumping" in the barometer, but that is not the case. "Pumping" rarely takes a minute from its lowest to its highest point, *i.e.* two minutes from one maximum to another,[1] whereas these maxima are at intervals of about half an hour.

Several explanations of these oscillations have been offered, and in my paper in the Proc. Roy. Soc. I have endeavoured to give a summary of them, but I have long felt that as a preliminary to a theory we ought to be sure of the facts.

Years ago, when Sir Francis Ronalds, F.R.S., had his collection of electrometers in the dome of Kew Observatory, he devised what he called a storm clock, which was really a paper going at a regular rate, so that the observer needed only to record the phenomena, and the position of his writing showed the time.

In 1890 we ought to do better than half a century ago, and, thanks to the great skill of MM. Richard Frères, of Paris, the new machine, if it does not absolutely justify its name "brontometer" (Βροντὴ μέτρον, thunderstorm measurer), is a very near approach to it.

And first as to the object, we want to find out (1) the nature of the oscillations already mentioned; and (2) to what they are due.

The only way to do this is to get them on so large a scale that they can be critically examined, and to find out with what phenomena they are synchronous, or in definite relation as to sequence and time. Irrespective altogether of these barometric oscillations there are several features in thunderstorms not at all understood, such, for instance, as whether the rush of rain which sometimes accompanies an exceptionally fine flash of lightning is the cause or the result of that flash. For this and other points absolutely accurate time is of the highest importance, and evidently all phenomena must be recorded on one sheet of paper.

A method adopted for some of his instruments by Mr. H. C. Russell, F.R.S., of Sydney, might with advantage be copied in some of the European Observatories. As a general rule, and for ordinary phenomena, half an inch of paper for an hour of time, *i.e.* 12 inches per diem, gives a sufficiently open scale; but when special phenomena occur it is very handy to be able to accelerate the speed five or ten times, and this Mr. Russell does with ease. But even ten times times the ordinary speed, or 5 inches an hour, would not enable one to read closer than to quarter minutes, which would be useless for ascertaining the details of a thunderstorm and the correlation of the various phenomena with the peculiar oscillations already mentioned.

These, then, are some of the reasons which led me, more than three years since, to consult MM. Richard as to the construction of the brontometer, now at length completed.

It is provided with endless paper, 12 inches wide, travelling under the various recording pens at the rate of 1·2 inch per minute, or 6 feet per hour. This is about 150 times faster than is usual in meteorological instruments, and enables the time of any phenomenon to be read off with certainty to a single second of time.

The traces are made in aniline ink by a series of seven Richard pens.

The first pen is driven by the clock which feeds the paper, so that the time scale and the paper must go together. The pen usually produces a straight line, which serves as the base line for all measurements, but at 55 seconds after each minute the pen begins to go, at an angle of about 45°, one-tenth of an inch to the left, and at the sixtieth second it flies back to its original position.

The second pen is driven by one of Richard's anemocinemographs—a name which they have given to a pattern of anemometer not yet known in England. The external portion has some resemblance to the ordinary windmill governor, but it differs from it in that the plates are curved, not flat; they are made of aluminium, and are so light that they have little momentum, and have thus a great advantage over cups, which run on for many seconds after the wind-force has decreased or ceased. The fans make one revolution for each metre of wind that passes, and send an electric current to the brontometer, where it acts on an electro-magnet, and tends to draw this (second) pen towards the left; but a train of clock-work is constantly tending to draw the pen to the right, the joint result being that the pen continuously shows, not the total motion (as is the case with most anemometers), but the actual velocity almost second by second. It does this certainly with an error of less than five seconds, for the fans will stop dead in less than that time, and the clock-work train will bring the pen from indicating a velocity of 70 miles an hour to 20 miles an hour in three seconds, and down to a dead calm in seven seconds. The trace will thus resemble that of a pressure anemometer, but with a much more open scale than was ever before available.

The third pen is actuated by a handle, and can be set at zero or at 1, 2, 3, or 4 spaces from it. The author's original idea was, partly by watching a storm-rain-gauge, and partly by estimation, to decide on the intensity of the rain, and to indicate that intensity by moving the pen further and further from zero as the fall becomes heavier. Experience alone will show whether that is, or is not, superior to moving it one step for each $\frac{1}{100}$th of an inch of fallen rain, which can be done by making a Crosley rain-gauge send a current into the room where the brontometer is placed, and strike a bell there. In a heavy storm there will, however, be so much for the observer to do, that very probably count would be lost. It may, therefore, be necessary to make it act automatically.

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[1] I believe that half a minute would be nearer, but until the brontometer has been worked during a heavy gale no one knows.

The fourth pen is actuated somewhat like a piano. On the occurrence of a flash of lightning, the observer presses a key, the pen travels slightly to the right, and flies back to zero. Referred to the automatic time-scale, this gives, to a second, the time at which the key was depressed.

The fifth pen is similar, but, being intended to record the thunder, the observer will continue to hold down the key until the roll is inaudible. The time of the departure of this pen from zero will evidently be later than that for the lightning by the time-interval due to the distance of the flash, and possibly something may be learned from the accurate record of the duration of the thunder.

The sixth pen is similar to the third, and is intended to record the time, duration, and intensity of hail.

The seventh and last pen is devoted to an automatic record of atmospheric pressure. As the rapid motion of the paper, which is indispensable for studying the details of a thunderstorm, has enlarged the time-scale more than a hundredfold, it was imperative that the barometric scale should itself be greatly enlarged. But the range of the barometer in London is more than 2½ inches, and no enlargement less than ten times the natural (mercurial) scale would be of any use; hence a breadth of 25 inches of paper would be necessary, unless some mode of shifting the indication could be devised.

Several plans were tried, but finally a modification of Richard's statoscope has been adopted, which is so sensitive that it will indicate the opening or shutting of a door in any part of the house, gives a scale of 30 inches for each mercurial inch (*i.e.* about three times that of a glycerine barometer), and yet only requires 4 inches breadth of the brontometer paper. Without entering into all the details of construction, it is desirable to explain the general principle, and its application. As it was essential that the apparatus should record accurately to 0·001 inch of mercurial barometric pressure, it was evident that friction had to be reduced to a minimum, and considerable motive power provided. This is done by placing in the base of the brontometer a galvanized iron chamber, which contains about 3½ cubic feet of air; on the upper part are a series of elastic chambers, similar to the vacuum boxes of aneroid barometers, but much larger. When the instrument is to be put in action, these chambers are connected with the large air-chamber, and a tap is closed which shuts off communication with the external air. Any subsequent increase, or decrease, of atmospheric pressure will compress, or allow to dilate, the air in these chambers, and the motion of the elastic ones produces that of the recording pen.

Obviously, any large change in the temperature of the confined air would vitiate the readings; but (1) the instrument is not required to give absolute, but merely differential, values, and (2) the influence of the changes of temperature is greatly reduced by the chamber being surrounded with 4 inches thick of non-conducting material, besides nearly 1 inch of wood outside of it. The change of temperature in a room, and during the short time that the statoscope will be worked without resetting to zero (*i.e.* without opening the tap) has not hitherto produced any measurable effect.

G. J. Symons.

NOTES.

The Société de Physique et d'Histoire naturelle de Genève has decided to celebrate its hundredth anniversary. It was founded in 1790, having originated in informal meetings of eminent men of science who lived at that time in Geneva. On October 23 a special meeting will be held, at which papers will be read relating to the history of the Society and to the labours of its members. It is hoped also that some honorary members may be disposed to contribute to the success of the meeting by sending scientific communications. In the evening there will be a banquet. Members who intend to be present are asked to write to M. de la Rive, the President, some days before the celebration.

The International Exhibition of Mining and Metallurgy, at the Crystal Palace, was officially opened on Monday by Lord Thurlow, F.R.S., one of the honorary vice-presidents of the Exhibition. We shall give some account of the Exhibition when the arrangement of the specimens is in a more forward state.

The British Medical Association is holding its fifty-eighth annual meeting at Birmingham. The President, Dr. Willoughby F. Wade, delivered the opening address on Tuesday. On Wednesday Sir Walter Foster delivered an address in medicine; to-day Mr. Lawson Tait delivers an address in surgery; and to-morrow, at the concluding general meeting, Dr. W. H. Broadbent will speak on therapeutics. At the meeting to-day the Association's gold medal "for distinguished service" will be presented to Surgeon Parke, of the Emin Relief Expedition.

The summer meeting of the Institution of Mechanical Engineers is being held at Sheffield. It began on Tuesday, July 29, and will not be concluded until to-morrow. The following is a list of the papers: on steel rails, considered chemically and mechanically, by Mr. Christer P. Sandberg, of London; on recent improvements in the mechanical engineering of coal-mines, by Mr. Emerson Bainbridge, of Sheffield; description of the Parkgate iron and steel works, by Mr. Charles J. Stoddart, managing director; description of the Sheffield water works, by Mr. Edward M. Eaton, engineer; description of the Loomis process of making gas for fuel, by Mr. R. N. Oakman, Jun., of London; on milling cutters, by Mr. George Addy, of Sheffield; on some different forms of gas furnaces, by Mr. Bernard Dawson, of Malvern; on the Elihu Thomson electric welding process, by Mr. W. C. Fish, of London (communicated through Prof. Alexander B. W. Kennedy, F.R.S., Vice-President).

The Leeds Executive Committee, appointed for the purpose of making arrangements for the visit of the British Association, met on Monday. The Mayor, Alderman Elmsley, in opening the proceedings, said that some of the most eminent men of science in Europe and America had announced their intention of being present. Many of the principal manufacturers of Leeds had most generously consented to open their works for inspection by members of the Association. Arrangements had also been made for excursions to places of interest, historical or otherwise. He had no doubt that the inhabitants of Leeds would show all the hospitality and enthusiasm that was required. In the course of the proceedings it was stated that it was the original intention to have a guarantee fund of not less than £500, but that fund now amounted to not less than £6540. A report of the Executive Committee recommended that a call of 50 per cent. should be made on the guarantors, but Mr. Benson Jowitt, in moving the adoption of the report, expressed his belief that eventually it would turn out that the call had been more than sufficient to meet the demands which had been made upon it. The Vicar of Leeds, Dr. Talbot, having seconded the adoption of the report, it was carried, and the proceedings terminated.